ความเป็นนวัตกร ความเครียดจากเทคโนโลยี การรับรู้ความง่ายในการใช้งาน และการรับรู้ความเสี่ยงในการยอมรับบริการธนาคารดิจิทัลของชุมชนชนกลุ่มน้อยในประเทศจีน

INNOVATIVENESS, TECHNOSTRESS, PERCEIVED EASE OF USE, AND PERCEIVED RISK IN DIGITAL BANKING ADOPTION AMONG AN ETHNIC MINORITY COMMUNITY IN CHINA

จิ่นเบียว ซุน[1] ชัยธนัตถ์กร ภวิศพิริยะกฤติ[1] และ สิทธิ์ ธีรสรณ์[2]
[1]วิทยาลัยนวัตกรรมและการจัดการ มหาวิทยาลัยราชภัฏสวนสุนันทา
[2]คณะวิทยาศาสตร์การกีฬาและสุขภาพ มหาวิทยาลัยเกษตรศาสตร์
Jinbiao Sun[1] Chaithanaskorn Phawitpiriyakliti[1] and Sid Terason[2]
[1]College of Innovation and Management, Suan Sunandha Rajabhat University
[2]Faculty of Sports and Health Science, Kasetsart University
(Received: May 27, 2026; Revised: July 10, 2026; Accepted: August 31, 2026)

บทคัดย่อ

การนำบริการดิจิทัลมาใช้ในชุมชนชนกลุ่มน้อยซึ่งมีข้อจำกัดด้านทรัพยากร แสดงให้เห็นว่าเทคโนโลยีเชื่อมโยงกับอัตลักษณ์ทางวัฒนธรรม ภาระทางความคิด และความเชื่อมั่นเชิงสถาบัน ในรูปแบบที่แบบจำลองการยอมรับทั่วไปยังอธิบายได้ไม่ครอบคลุมเพียงพอ งานวิจัยนี้ซึ่งเป็นการศึกษาครั้งที่ 2 ของโครงการวิจัยแบบคู่ขนาน มุ่งศึกษาปัจจัยที่กำหนดความตั้งใจยอมรับบริการธนาคารดิจิทัลของประชาชนที่อาศัยอยู่ในเขตปกครองตนเองทิเบตกานซี สาธารณรัฐประชาชนจีน โดยต่อยอดแบบจำลองการยอมรับเทคโนโลยี (TAM) ด้วยตัวแปรความเครียดจากเทคโนโลยี การรับรู้ความเสี่ยง ความเป็นนวัตกร และความไว้วางใจ ข้อมูลได้จากแบบสอบถามที่ใช้วิเคราะห์ได้ 394 ชุด ซึ่งเก็บด้วยการสุ่มตัวอย่างหลายขั้นตอน และวิเคราะห์แบบจำลองการส่งผ่านที่มีตัวแปรกำกับด้วย PLS-SEM ผลการศึกษาชี้ให้เห็นว่า การรับรู้ประโยชน์ใช้สอยเป็นกลไกส่งผ่านอิทธิพลของความเป็นนวัตกร ความเครียดจากเทคโนโลยี และการรับรู้ความง่ายในการใช้งาน ไปยังความตั้งใจใช้ธนาคารดิจิทัล ขณะที่การรับรู้ความเสี่ยงทำให้ความสัมพันธ์ระหว่างการรับรู้ประโยชน์ใช้สอยกับความตั้งใจอ่อนลง และความไว้วางใจเป็นหนึ่งในตัวทำนายทางตรงที่มีอิทธิพลสูงสุด โดยสมมติฐานทั้งสิบข้อได้รับการยืนยัน ข้อค้นพบดังกล่าวสนับสนุนแนวคิดการรวมดิจิทัลและทฤษฎีการยอมรับเทคโนโลยี และแสดงว่าในพื้นที่ที่ถูกกีดกันทางการเงินและมีเอกลักษณ์ทางวัฒนธรรมสูง ความตั้งใจยอมรับขึ้นอยู่กับความไว้วางใจที่ก่อตัวผ่านชุมชน ปฏิกิริยาทางอารมณ์ต่อการออกแบบหน้าจอแอปพลิเคชัน และการรับรู้ความเสี่ยงที่หยั่งรากในวัฒนธรรม ซึ่งเป็นสิ่งที่แบบจำลองเชิงเหตุผลแบบดั้งเดิมยังไม่สามารถคาดการณ์ได้อย่างแม่นยำ

คำสำคัญ: การรวมดิจิทัล; ช่องว่างทางดิจิทัล; การยอมรับเทคโนโลยี; ความเครียดจากเทคโนโลยี; ชุมชนชนกลุ่มน้อย

ABSTRACT

Digital service uptake in ethnically distinct, resource-limited communities shows that technology becomes entangled with cultural identity, cognitive strain, and institutional trust in ways that conventional adoption models do not fully explain. As the second study of a parallel-study research project, this study investigates the determinants of D-banking adoption intention among residents of Ganzi Tibetan Autonomous Prefecture—a severely underserved ethnic minority area of China—by augmenting the Technology Acceptance Model with Technostress, Perceived Risk, Innovativeness, and Trust. Using 394 valid responses and a moderated mediation model in PLS-SEM, results showed that Perceived Usefulness transmitted the effects of Innovativeness, Technostress, and Perceived Ease of Use to Intention to Use D-banking; Perceived Risk weakened the Perceived Usefulness–Intention link; and Trust was among the most powerful direct predictors, and all ten hypotheses were supported. The results indicate that in financially excluded and culturally distinctive settings, adoption intention depends as much on community-built trust, emotional reactions to interface design, and culturally rooted perceptions of risk as on rational utility assessments, with direct implications for inclusive fintech design and digital inclusion policy.

Keywords: Digital Inclusion, Digital Divide, Technology Acceptance, Technostress, Ethnic Minority Communities

INTRODUCTION

Digital banking (D-banking) has become a key tool for promoting financial inclusion, allowing people to manage accounts, make payments, and save through mobile platforms without relying on physical branch networks (Arner et al., 2020). China has formalized its commitment to digital inclusive finance in the Fintech Development Plan (2022–2025), which calls for fintech to be fully leveraged to close the urban–rural digital gap (People's Bank of China, 2022). Behind headline penetration figures, however, lie persistent structural disparities tied to ethnicity, geography, and cultural distance from formal financial institutions—disparities that current frameworks have not adequately confronted.

Ganzi Tibetan Autonomous Prefecture, located on the southeastern edge of the Qinghai–Tibet Plateau at altitudes above 3,500 meters, illustrates this paradox. The prefecture has roughly 1.2 million inhabitants, 82.3% of whom are Tibetan (Ganzi Bureau of Statistics, 2023); its density of banking outlets is just 45% of the national average, and 4G coverage in pastoral areas is under 60% (Wang & Yang, 2024). Although considerable policy resources have been invested, uptake of the Sichuan Rural Commercial Bank (SCRB) mobile application is still weak, held back by low digital literacy, culturally rooted perceptions of risk, and Technostress arising from complex interfaces and unreliable infrastructure.

Three gaps underlie this study. First, little empirical work has examined how Technostress inhibits adoption in digitally underserved ethnic minority communities (Tarafdar et al., 2019). Second, Perceived Risk is usually modeled as a direct antecedent of intention, whereas its moderating role—weakening the utility–intention link when risk is high—is rarely tested in rural, resource-poor settings (Featherman & Pavlou, 2003). Third, community-mediated institutional trust—where confidence in a digital system comes from collective social endorsement rather than personal experience—remains untheorized in ethnic minority digital inclusion. This study therefore develops an extended TAM in which Innovativeness, Technostress, Perceived Ease of Use, and Trust are antecedents, Perceived Usefulness mediates, and Perceived Risk works both as a direct deterrent and as a contextual moderator. The model was tested via PLS-SEM using data from 394 Ganzi residents.

The Technology Acceptance Model (TAM; Davis, 1989) provides the core explanatory structure, positing that Perceived Ease of Use and Perceived Usefulness together shape behavioral intention; here the standard model is broadened to include dispositional antecedents, negative affective states, and contextual risk factors needed to explain adoption in Ganzi's setting. Diffusion of Innovations Theory (DOI; Rogers, 2003) complements TAM by adding Innovativeness as a dispositional antecedent that shapes both direct adoption intention and utility perceptions, in line with Agarwal and Prasad's (1998) evidence that personal innovativeness predicts Perceived Usefulness and adoption intention.

Innovativeness and D-Banking Adoption

Innovativeness—a dispositional inclination to try new technologies voluntarily before others do (Goldsmith & Hofacker, 1991)—works through two routes in D-banking settings: a direct route, by creating intrinsic motivation to engage with new features, and an indirect route, by framing utility perceptions through an approach rather than an anxiety orientation (Agarwal & Prasad, 1998; Chen & Hu, 2023). H1: Innovativeness has a positive effect on Intention to Use D-banking. H4: Perceived Usefulness mediates the link between Innovativeness and Intention to Use D-banking.

Technostress and D-Banking Adoption

Technostress—a negative psychological condition that emerges when the demands of technology exceed an individual's perceived coping capacity (Tarafdar et al., 2019)—appears in Ganzi as interface complexity, fear of making irreversible transaction mistakes, and anxiety caused by unstable networks. It affects adoption along two routes: a direct avoidance mechanism that dampens intention, and an indirect route that hampers the cognitive appraisal of technological benefits and thus weakens Perceived Usefulness (Ahmad et al., 2023). H2: Technostress has a negative effect on Intention to Use D-banking. H5: Perceived Usefulness mediates the link between Technostress and Intention to Use D-banking.

Perceived Ease of Use and D-Banking Adoption

Perceived Ease of Use—the extent to which a system is seen as requiring little effort (Davis, 1989)—lowers cognitive load and builds confidence among people with limited digital literacy. Its effect runs along a direct route (systems that feel effortless are inherently favored) and an indirect route via the ease-of-use heuristic, through which users judge usefulness from how usable a system appears (Venkatesh & Davis, 2000). H3: Perceived Ease of Use has a positive effect on Intention to Use D-banking. H6: Perceived Usefulness mediates the link between Perceived Ease of Use and Intention to Use D-banking.

Perceived Usefulness, Trust, and Perceived Risk

Perceived Usefulness (Davis, 1989) acts as the main cognitive mediator, combining dispositional, usability, and affective inputs into an overall judgment of functional value. H7: Perceived Usefulness has a positive effect on Intention to Use D-banking. Trust—a user's conviction that the platform is dependable and able to safeguard their financial interests (McKnight et al., 2002)—functions in Ganzi as a hybrid construct that merges confidence in regulation with social validation transmitted through the community; in line with Trust Transfer Theory, long familiarity with SCRB's physical branches offers a heuristic for judging its digital platform (Yu et al., 2020). H8: Trust has a positive effect on Intention to Use D-banking. Perceived Risk covers financial loss, privacy breaches, and psychological discomfort (Featherman & Pavlou, 2003); in Ganzi it plays a dual role: as a direct deterrent that triggers loss-aversion heuristics, and as a moderator that weakens the Perceived Usefulness–Intention link when risk is high. H9: Perceived Risk negatively moderates the Perceived Usefulness–Intention link. H10: Perceived Risk has a negative effect on Intention to Use D-banking.

RESEARCH OBJECTIVES

1. To investigate the direct influences of Innovativeness, Technostress, Perceived Ease of Use, Trust, and Perceived Risk on Intention to Use D-banking among people living in Ganzi Tibetan Autonomous Prefecture.

2. To investigate whether Perceived Usefulness mediates the relationships between Innovativeness, Technostress, and Perceived Ease of Use and the Intention to Use D-banking among residents of Ganzi.

3. To investigate whether Perceived Risk moderates the link between Perceived Usefulness and Intention to Use D-banking.

Figure 1 brings the hypothesized relationships together in a single conceptual model of the study. Innovativeness, Technostress, and Perceived Ease of Use are specified as antecedents that affect Intention to Use D-banking directly (H1–H3) and also indirectly via Perceived Usefulness (H4–H6); Perceived Usefulness (H7), Trust (H8), and Perceived Risk (H10) have direct

effects on intention, and Perceived Risk further moderates the relationship between Perceived Usefulness and Intention (H9).

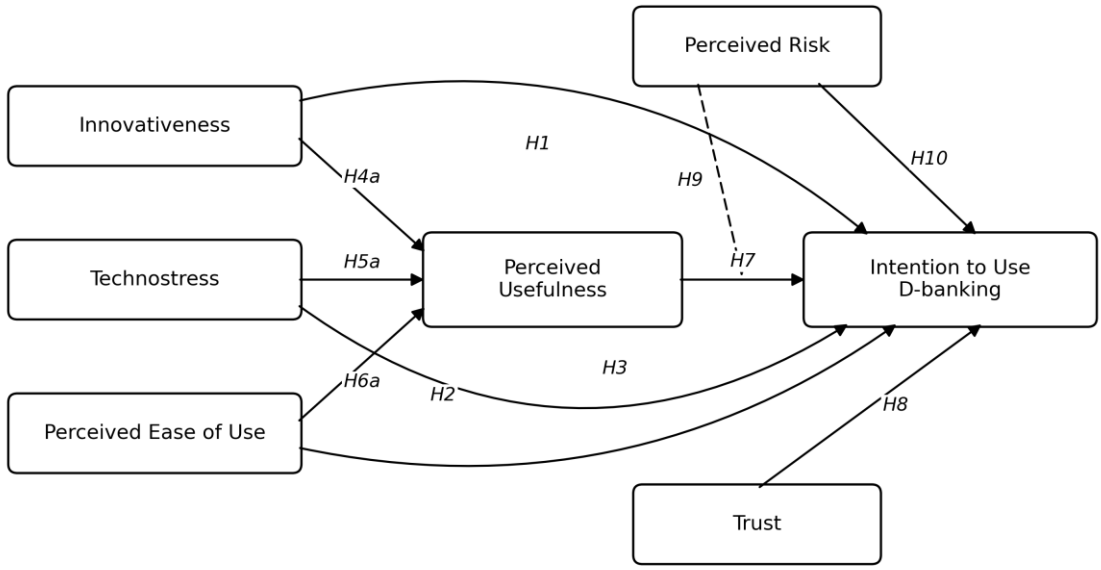


Figure 1 *Conceptual Model of the Study*

Note. Solid arrows denote hypothesized direct effects; the dashed arrow denotes the hypothesized moderating effect of Perceived Risk (H9). H4a–H6a are the first-stage paths of the mediation hypotheses H4–H6.

METHOD

1. Population and Sample

A multi-stage sampling design was used to secure proportional coverage of all eighteen counties in Ganzi. The target population consisted of permanent residents aged 18 or older who owned a smartphone, with special attention given to farmers, herders, small business owners, and people aged 45 or older.

Sampling was carried out in three stages. First, the eighteen counties of Ganzi were grouped into three strata according to their level of urbanization and density of banking outlets, and two counties were drawn at random from each stratum, giving six counties. Second, three townships were drawn at random from the administrative township list of each selected county. Third, respondents within each township were recruited through systematic sampling at bank branches, markets, and village service centers, and county quotas were set in proportion to the registered population figures published in the prefecture statistical yearbook

(Ganzi Bureau of Statistics, 2023) so that the sample mirrored the distribution of the population across counties.

2. Instruments

All constructs used multi-item reflective scales on a 5-point Likert format (1 = Strongly Disagree, 5 = Strongly Agree). Innovativeness (6 items) drew on Goldsmith and Hofacker (1991) and Agarwal and Prasad (1998). Technostress (8 items) drew on Tarafdar et al. (2019) and Ragu-Nathan et al. (2008) to capture anxiety and cognitive overload from using the SCRB APP. Perceived Ease of Use (6 items) and Perceived Usefulness (6 items) were based on Davis (1989) and tailored to activities relevant to Ganzi. Perceived Risk (5 items) was based on Featherman and Pavlou (2003). Trust (6 items) covered both institutional confidence and community-mediated trust (McKnight et al., 2002; Yu et al., 2020). Intention to Use D-banking (5 items) was based on Ajzen (1991) and Al-Adwan et al. (2023). A pilot test (n = 32) produced Cronbach's α values of .81–.90, and a panel of five experts established content validity (S-CVI/Ave = .86–.93). To reduce common method bias, construct order was randomized, response formats were varied, and anonymity was assured (Podsakoff et al., 2012). The Suan Sunandha Rajabhat University IRB granted ethics approval.

3. Data Collection

Overall, 500 questionnaires were distributed online in Mandarin Chinese via the Wenjuanxing platform between March and June 2025, with trained local enumerators assisting participants with limited digital literacy. Of the 421 questionnaires returned (84.2% return rate), 27 were removed for excessive missing data (n = 11), straight-lining (n = 9), or ineligibility (n = 7), leaving 394 usable responses (78.8% effective response rate). This exceeds the SEM minimum of 200 (Kline, 2023) and the a priori G*Power minimum of 76 (f^2 = .15, α = .05, power = .80; Faul et al., 2009). Independent-samples t-tests for nonresponse bias showed no significant differences between early and late respondents in age (t = 0.92, p = .359), digital literacy (t = 1.07, p = .286), or any primary construct (all $p > .20$).

Since 41.4% of respondents identified Tibetan as their primary language, specific steps were taken to address language barriers. Two bilingual academics translated the Mandarin instrument into Tibetan following a translation–back-translation procedure, and a third bilingual reviewer resolved any discrepancies; respondents could choose the language version they preferred. All enumerators were locally recruited bilingual Tibetan–Mandarin speakers who had been trained to read items aloud in the local Kham Tibetan dialect for respondents with limited literacy, without rewording the content of any item. The pilot test included Tibetan-primary speakers to verify that items were comprehensible in both language versions, which helped protect response quality and measurement equivalence.

4. Data Analysis

PLS-SEM was carried out in SmartPLS 4, chosen for its predictive orientation, the model's complexity, non-normal data distributions, and the study's exploratory nature (Hair et al., 2022). The analysis had two stages: assessment of the measurement model (indicator reliability, internal consistency, convergent validity, and discriminant validity), then assessment of the structural model (collinearity diagnostics, direct path coefficients, mediation using bootstrapping with 5,000 subsamples and bias-corrected confidence intervals, moderation using orthogonalized product-indicator terms, R^2, Q^2, and SRMR).

RESULTS

Preliminary Analysis and Sample Characteristics

Little's MCAR test showed data were missing completely at random (χ^2 = 287.41, *df* = 276, *p* = .312), and 1.09% missing values were imputed via expectation-maximization. Harman's single-factor test (first factor = 28.63% of variance) and full collinearity VIF values (1.18–2.84, all < 3.3) showed that common method bias was not a serious concern (Kock, 2015). Respondents comprised farmers and herders (36.8%), small business owners (22.3%), students (14.5%), retirees (12.7%), and government employees (13.7%). Overall, 41.4% named Tibetan as their primary language, 38.6% Mandarin, and 20.0% reported bilingual use, and only 34.5% had used a smartphone for any financial activity in the previous month.

Measurement Model

The measurement model showed adequate psychometric properties (Table 1). Every outer loading was above .708, composite reliability (CR) values fell between .898 and .924, and average variance extracted (AVE) values fell between .548 and .596, supporting indicator reliability, internal consistency, and convergent validity (Hair et al., 2022). Perceived Risk had the highest mean (*M* = 3.64, *SD* = 0.68), followed by Perceived Usefulness (*M* = 3.55), Innovativeness (*M* = 3.47), Intention to Use (*M* = 3.43), Perceived Ease of Use (*M* = 3.38), Trust (*M* = 3.29), and Technostress (*M* = 3.21). Skewness and kurtosis values were all within ±2.

Table 1 *Descriptive Statistics, Reliability, and Convergent Validity*

Construct	Items	*M*	*SD*	λ range	CR	*AVE*
INN	6	3.47	0.74	.72–.86	.91	.58
TS	8	3.21	0.79	.72–.86	.92	.56
PEOU	6	3.38	0.77	.73–.87	.91	.57
PU	6	3.55	0.71	.74–.87	.91	.58
PR	5	3.64	0.68	.73–.85	.90	.55
Trust	6	3.29	0.82	.73–.87	.92	.59
ITU	5	3.43	0.76	.75–.88	.92	.60

Note. INN = Innovativeness; TS = Technostress; PEOU = Perceived Ease of Use; PU = Perceived Usefulness; PR = Perceived Risk; ITU = Intention to Use D-banking; λ = outer loading range; CR = composite reliability; *AVE* = average variance extracted.

The Fornell-Larcker criterion supported discriminant validity (Table 2), since every √AVE value on the diagonal exceeded the corresponding inter-construct correlations; the HTMT ratios also supported it (Table 3), as all were under the .85 threshold (Henseler et al., 2015), and the largest ratio was .741 (Trust–ITU).

Table 2 *Discriminant Validity: Fornell-Larcker Criterion*

	1	2	3	4	5	6	7
1. INN	**.76**						
2. TS	−.41	**.75**					
3. PEOU	.48	−.39	**.76**				
4. PU	.53	−.44	.51	**.76**			
5. PR	−.40	.46	−.37	−.49	**.74**		
6. Trust	.44	−.35	.47	.49	−.42	**.77**	
7. ITU	.49	−.42	.44	.57	−.51	.53	**.77**

Note. Diagonal values (bold) = √*AVE*. INN = Innovativeness; TS = Technostress; PEOU = Perceived Ease of Use; PU = Perceived Usefulness; PR = Perceived Risk; Trust = Trust; ITU = Intention to Use D-banking.

Table 3 *Heterotrait-Monotrait (HTMT) Ratios*

	1	2	3	4	5	6	7
1. INN	—						
2. TS	.49	—					
3. PEOU	.55	.45	—				
4. PU	.61	.52	.60	—			
5. PR	.46	.54	.44	.57	—		
6. Trust	.51	.41	.54	.57	.49	—	
7. ITU	.56	.49	.51	.67	.60	.74	—

Note. HTMT ratios from 5,000-subsample bootstrapping. All values below the .85 threshold (Henseler et al., 2015). 1 = INN; 2 = TS; 3 = PEOU; 4 = PU; 5 = PR; 6 = Trust; 7 = ITU.

Structural Model and Hypothesis Testing

No multicollinearity was present, as all inner model VIF values ranged from 1.00 to 2.84. The model accounted for a substantial share of variance in the endogenous constructs, with R^2 = .38 for Perceived Usefulness and R^2 = .54 (adjusted R^2 = .53) for Intention to Use D-banking. Q^2 values obtained through blindfolding were positive for both constructs (Perceived Usefulness = .22; Intention to Use = .31), indicating predictive relevance, and the overall fit of the model was acceptable (SRMR = .052, under the .08 threshold; Hair et al., 2022). The direct path coefficients are shown in Table 4. The paths from Innovativeness, Technostress, and Perceived Ease of Use to Perceived Usefulness are labeled H4a, H5a, and H6a in Table 4; they represent the first-stage paths of mediation hypotheses H4–H6 rather than distinct direct-effect hypotheses, and their significance is a prerequisite for the indirect effects shown in Table 5. Among the direct effects on Intention to Use D-banking, Perceived Usefulness was the strongest (H7: β = .32; $p < .001$; f^2 = .11), followed by Trust (H8: β = .24; $p < .001$), Perceived Risk (H10: β = −.20; $p < .001$), Innovativeness (H1: β = .18; $p < .001$), Perceived Ease of Use (H3: β = .17; p = .001), and Technostress (H2: β = −.16; $p < .001$). The moderation hypothesis (H9) received support, as the Perceived Risk × Perceived Usefulness interaction term was negative and significant (β = −.15; $p < .001$). Simple slope analysis showed that the Perceived Usefulness–Intention slope at low Perceived Risk (β = .43; $p < .001$) became considerably weaker at high Perceived Risk (β = .21; p = .003), indicating partial moderation in line with the privacy calculus framework (Featherman & Pavlou, 2003).

Table 4 *Structural Path Coefficients, Effect Sizes, and Hypothesis Testing*

Path	β	*SE*	*t*	*p*	95% CI	f^2
INN ⟶ PU (H4a)	.27	.052	5.24	< .001	[.17, .37]	.08
TS ⟶ PU (H5a)	−.21	.053	3.96	< .001	[−.32, −.11]	.06
PEOU ⟶ PU (H6a)	.31	.052	6.00	< .001	[.21, .41]	.11
INN ⟶ ITU (H1)	.18	.046	3.89	< .001	[.09, .28]	.04
TS ⟶ ITU (H2)	−.16	.048	3.31	< .001	[−.26, −.07]	.03
PEOU ⟶ ITU (H3)	.17	.051	3.35	.001	[.07, .27]	.03
PU ⟶ ITU (H7)	.32	.053	6.00	< .001	[.21, .42]	.11
Trust ⟶ ITU (H8)	.24	.048	5.02	< .001	[.15, .34]	.07
PR ⟶ ITU (H10)	−.20	.047	4.30	< .001	[−.29, −.11]	.05
PR × PU ⟶ ITU (H9)	−.15	.043	3.50	< .001	[−.23, −.07]	.03

Note. β = standardized path coefficient; *SE* = standard error; CI = bias-corrected confidence interval. f^2 benchmarks: .02 = small, .15 = medium, .35 = large (Cohen, 1988). Bootstrapping: 5,000 subsamples. Paths H4a–H6a are the first-stage paths of mediation hypotheses H4–H6 (Table 5) and were therefore not assigned separate direct-effect hypotheses; SE values are reported to three decimals as obtained from the bootstrap output.

Mediation results are reported in Table 5. All three indirect effects via Perceived Usefulness were significant (no 95% BCa CI contained zero), supporting H4, H5, and H6. With both direct and indirect effects significant, each relationship reflects partial mediation. VAF ranged from 29.6% to 36.7%; the mediated path was strongest for Perceived Ease of Use (VAF = 36.7%), then Innovativeness (31.7%) and Technostress (29.6%).

Table 5 *Mediation Analysis: Indirect Effects via Perceived Usefulness*

Path	β	*SE*	*t*	*p*	95% CI	VAF
H4: INN ⟶ PU ⟶ ITU	.09	.024	3.70	< .001	[.04, .13]	31.7%
H5: TS ⟶ PU ⟶ ITU	−.07	.023	3.09	.002	[−.11, −.03]	29.6%
H6: PEOU ⟶ PU ⟶ ITU	.10	.026	3.81	< .001	[.05, .15]	36.7%

Note. VAF = variance accounted for. Partial mediation: both direct and indirect effects significant.

DISCUSSION

Support was found for all ten hypotheses. Four key insights follow: Trust ranks among the strongest direct predictors of adoption intention; Technostress acts as a barrier along two pathways; Perceived Risk serves as a moderating boundary condition; and Perceived Usefulness partially mediates the effects of all three cognitive and dispositional antecedents.

Trust as a Dominant Predictor

Trust had a strong direct effect on Intention to Use D-banking (H8: β = .24; f^2 = .07), which carries McKnight et al.'s (2002) framework of institutional trust into a Tibetan minority setting in which Trust combines confidence in regulation with social validation mediated by the community. That Trust stands out relative to the cognitive antecedents implies that an affective sense of safety is a prerequisite for adoption in communities where physical cash holds a symbolic legitimacy that rational utility judgments cannot replace (Kaur et al., 2020; Yu et al., 2020). The Trust Transfer Theory mechanism suggests that SCRB's existing branch network could act as a bridge of trust toward digital adoption, although an alternative explanation—that the strong Trust effects partly stem from acquiescence bias among respondents who link SCRB with state authority—should be tested in future research with behavioral or implicit measures.

Technostress as a Dual-Pathway Barrier

Technostress acted as an adoption barrier along two pathways (H2: β = −.16 direct; H5: indirect β = −.07; VAF = 29.6%). The direct pathway reflects avoidance: when the demands of the SCRB APP outstrip perceived coping resources, anxiety converts directly into lower intention. The indirect pathway shows that Technostress also undermines the cognitive capacity needed to appraise technological benefits, in line with Tarafdar et al.'s (2019) argument that Technostress narrows attention and heightens risk aversion. Measures that reduce interface complexity—voice navigation in Tibetan, icon-based transaction flows, one-tap access, and real-time error recovery—would raise both Perceived Usefulness appraisals and direct adoption intention at once, increasing the return on investment through this dual-channel mechanism (Ahmad et al., 2023).

Perceived Risk as a Moderating Boundary Condition

The moderation result (H9: β = −.15) positions Perceived Risk as a contextual boundary condition and not simply an additive predictor. The Perceived Usefulness–Intention slope stayed significant under high Perceived Risk (β = .21; p = .003) but was considerably weaker than under low risk (β = .43), indicating partial moderation in line with the privacy calculus framework (Featherman & Pavlou, 2003; Tran et al., 2023). In Ganzi, where rumors of digital fraud spread quickly through close-knit community networks, a sizable share of residents may remain risk-averse whatever their usefulness perceptions, which means that adoption strategies

centered on utility must be paired with risk-mitigation messages communicated through trusted local channels.

Perceived Usefulness as the Central Mediating Mechanism

Partial mediation across all paths (VAF: 29.6%–36.7%) supports TAM's core proposition while extending it. Perceived Ease of Use produced the largest indirect effect (H6: β = .10; VAF = 36.7%), mirroring the ease-of-use heuristic (Venkatesh & Davis, 2000), and Innovativeness influenced utility perceptions (H4: β = .09; VAF = 31.7%), in keeping with the TAM-DOI integration advanced here. That mediation was partial rather than full on every pathway shows that each antecedent operates through both a cognitive-evaluative channel and a direct channel not reliant on utility appraisal, implying that adoption interventions should target affective and motivational antecedents alongside utility-based messaging.

Reflexive Consideration of Uniform Hypothesis Support

That all ten hypotheses were supported calls for critical reflection rather than uncritical acceptance, and three complementary explanations are plausible. First, the hypothesized relationships were intentionally conservative: each path reproduces associations validated repeatedly in the TAM, DOI, and Technostress literatures, so the uniform support mainly reflects the maturity of the underlying theory rather than unexpected new effects; moreover, the effect sizes observed were modest (f^2 = .03–.11), which does not fit inflated or artifactual estimation. Second, the sample (N = 394) offered statistical power far beyond the a priori minimum, making Type II errors improbable even for small effects; with such power, small but theoretically grounded effects can be detected, so their uniform significance is not statistically surprising. Third, a methodological explanation cannot be ruled out: even with procedural remedies and satisfactory Harman and full-collinearity results, single-source perceptual data can exaggerate the consistency of relationships that point in the same direction, and acquiescence tendencies in a survey delivered with enumerator help may make responses more uniform. Still, support for the moderation hypothesis (H9) shows that the model can detect boundary conditions and does not merely confirm main effects, and the behavioral-data extensions suggested among the limitations would offer the most rigorous test of whether this uniform pattern holds beyond self-report.

Theoretical Contributions

The study offers four theoretical contributions. First, it broadens TAM by adding Technostress as an inhibitor operating through two pathways, questioning the usual assumption that cognitive evaluation in IS adoption research is affectively neutral and answering the call by Alalwan et al. (2017) for TAM extensions that address negative affective states in emerging markets. Second, it recasts Perceived Risk as a moderating boundary condition instead of an additive predictor, giving a theoretically sharper explanation of how perceptions of risk shape adoption in highly uncertain environments. Third, it shows that Trust

acts as a dominant direct predictor of a magnitude similar to that of Perceived Usefulness, which calls into question the implicit universality of standard TAM and UTAUT frameworks in ethnically distinct settings. Fourth, it adds to research on the digital divide (van Dijk, 2006; Warschauer, 2004) by supplying quantitative evidence from a Tibetan autonomous prefecture and by identifying second-order divide factors (Technostress, Trust, Perceived Risk) as the main determinants of whether first-order access leads to meaningful adoption—a model that can be transferred to similar contexts in Southeast Asia, Central Asia, and sub-Saharan Africa.

CONCLUSION

The study offers empirical evidence that adopting D-banking in Ganzi Tibetan Autonomous Prefecture is a process with psychological and cultural layers that standard TAM frameworks cannot fully explain. Three main conclusions can be drawn. First, Trust, and not functional utility alone, is a dominant driver of adoption, underscoring the indispensable role of institutional and community-mediated trust where formal digital financial services are still emerging. Second, Technostress forms a significant barrier along two pathways, acting through direct avoidance and through indirect impairment of utility appraisal, which shows that the adoption problem facing the SCRB APP is as much about psychological design as about technological access. Third, Perceived Risk serves as a moderating boundary condition that consistently weakens the utility–intention relationship, suggesting that adoption strategies focused on utility will fall short unless they are accompanied by culturally sensitive risk mitigation. Taken together, the results show that the universality assumed by TAM does not hold empirically in communities where trust is embedded in institutions, risk is magnified by culture, and digital interfaces produce psychological strain instead of confident engagement.

RECOMMENDATIONS

For SCRB and policymakers, the results suggest that digital inclusion goals cannot be met through infrastructure investment alone. Trust-building efforts should build on existing branch relationships via community intermediary networks and holding in-branch APP demonstrations in Tibetan. Interface redesign should go beyond translation, adopting participatory co-design with Tibetan farmers, herders, and older users and favoring voice navigation, icon-based flows, and real-time error recovery so that Technostress is reduced at its source (Norman, 2013). Risk-reduction communication, delivered through local Buddhist temples and village governance structures, is needed to overcome risk-driven refusals to adopt that utility arguments alone cannot resolve. Nevertheless, enlisting religious institutions in support of what is, in the end, a commercial service calls for substantial cultural and political sensitivity in the Chinese context: any involvement of monasteries should be purely informational and never promotional, should occur only with the informed consent of

monastic authorities and in line with the regulations on religious affairs, and be kept clearly apart from sales targets or incentive schemes. Where such sensitivities emerge, secular channels—village committees, township service centers, and agricultural cooperatives—should be the preferred primary conduits, and community intermediaries should be selected for their standing rather than their institutional affiliation.

Several limitations should be noted. Because the design was cross-sectional, causal conclusions cannot be drawn; longitudinal studies are required to trace how the development of Trust and the reduction of Perceived Risk unfold over time. Focusing on Ganzi alone restricts generalizability, and comparative research across other ethnic minority autonomous prefectures (Yunnan, Xinjiang, Inner Mongolia) would clarify the boundary conditions of the model. Perceptual data from single informants may introduce response bias, so future studies should combine perceptual measures with behavioral indicators such as SCRB APP usage logs. Technostress was modeled as a unidimensional composite; future work should break it down into the sub-dimensions proposed by Tarafdar et al. (2019) (techno-overload, techno-complexity, techno-insecurity) to determine which types of digital strain matter most in ethnic minority D-banking contexts.

REFERENCES

Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. **Information Systems Research**, **9**(2), 204–215. https://doi.org/10.1287/isre.9.2.204

Ahmad, S., Bhatti, S. H., & Hwang, Y. (2023). Technostress and employees' digital work behavior. **Internet Research**, **33**(5), 1929–1958. https://doi.org/10.1108/INTR-05-2022-0329

Ajzen, I. (1991). The theory of planned behavior. **Organizational Behavior and Human Decision Processes**, **50**(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Al-Adwan, A. S., Al-Adwan, A., & Berger, H. (2023). Unlocking the black box of technology adoption. **Technology in Society**, **73**, Article 102250. https://doi.org/10.1016/j.techsoc.2023.102250

Alalwan, A. A., Dwivedi, Y. K., & Rana, N. P. (2017). Factors influencing adoption of mobile banking by Jordanian bank customers: Extending UTAUT2 with trust. **International Journal of Information Management**, **37**(3), 99–110. https://doi.org/10.1016/j.ijinfomgt.2017.01.002

Arner, D. W., Barberis, J., & Buckley, R. P. (2020). FinTech, RegTech, and the reconceptualization of financial regulation. **Northwestern Journal of International Law & Business**, **40**(1), 1–38.

Chen, Y., & Hu, X. (2023). Consumer innovativeness, perceived value, and smart wearable device adoption. **Frontiers in Psychology**, **14**, Article 1172004. https://doi.org/10.3389/fpsyg.2023.1172004

Cohen, J. (1988). **Statistical power analysis for the behavioral sciences** (2nd ed.). Lawrence Erlbaum Associates.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. **MIS Quarterly**, **13**(3), 319–340. https://doi.org/10.2307/249008

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1. **Behavior Research Methods**, **41**(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: A perceived risk facets perspective. **International Journal of Human–Computer Studies**, **59**(4), 451–474. https://doi.org/10.1016/S1071-5819(03)00111-3

Ganzi Tibetan Autonomous Prefecture Bureau of Statistics. (2023). **Ganzi Prefecture 2023 statistical yearbook**. Ganzi Bureau of Statistics.

Goldsmith, R. E., & Hofacker, C. F. (1991). Measuring consumer innovativeness. **Journal of the Academy of Marketing Science**, **19**(3), 209–221. https://doi.org/10.1007/BF02726497

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). **A primer on partial least squares structural equation modeling (PLS-SEM)** (3rd ed.). Sage.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based SEM. **Journal of the Academy of Marketing Science**, **43**(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Kaur, P., Dhir, A., Singh, N., Sahu, G., & Almotairi, M. (2020). An innovation resistance theory perspective on mobile payment solutions. **Journal of Retailing and Consumer Services**, **55**, Article 102059. https://doi.org/10.1016/j.jretconser.2020.102059

Kline, R. B. (2023). **Principles and practice of structural equation modeling** (5th ed.). Guilford Press.

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. **International Journal of e-Collaboration**, **11**(4), 1–10. https://doi.org/10.4018/ijec.2015100101

McKnight, D. H., Choudhury, V., & Kacmar, C. (2002). Developing and validating trust measures for e-commerce. **Information Systems Research**, **13**(3), 334–359. https://doi.org/10.1287/isre.13.3.334.81

Norman, D. A. (2013). **The design of everyday things** (Rev. ed.). Basic Books.

People's Bank of China. (2022). **Fintech development plan (2022–2025)**. People's Bank of China.

Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. **Annual Review of Psychology**, **63**, 539–569. https://doi.org/10.1146/annurev-psych-120710-100452

Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., & Tu, Q. (2008). The consequences of technostress for end users in organizations: Conceptual development and empirical validation. **Information Systems Research**, **19**(4), 417–433. https://doi.org/10.1287/isre.1070.0165

Rogers, E. M. (2003). **Diffusion of innovations** (5th ed.). Free Press.

Tarafdar, M., Maier, C., Laumer, S., & Weitzel, T. (2019). Explaining the link between technostress and technology addiction. **Information Systems Journal**, **29**(6), 1279–1310.

Tran, L. T. T., Nguyen, P. T. H., & Nguyen, N. D. (2023). Perceived risk and mobile payment adoption in Southeast Asia. **Finance Research Letters**, **57**, Article 104236. https://doi.org/10.1016/j.frl.2023.104236

van Dijk, J. A. G. M. (2006). Digital divide research, achievements and shortcomings. **Poetics**, **34**(4–5), 221–235. https://doi.org/10.1016/j.poetic.2006.05.004

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. **Management Science**, **46**(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Wang, J., & Yang, S. (2024). Infrastructure constraints and digital service access in remote regions. **China Rural Survey**, **42**(1), 98–114.

Warschauer, M. (2004). **Technology and social inclusion: Rethinking the digital divide**. MIT Press.

Yu, L., Li, H., He, W., Wang, F. K., & Jiao, S. (2020). A meta-analysis to explore privacy cognition and information disclosure of internet users. **International Journal of Information Management**, **51**, Article 102015. https://doi.org/10.1016/j.ijinfomgt.2019.09.011